California Public Utilities Commission

# Utility Workforce Development

## *Should the CPUC Play a Role in this Issue?*

## POLICY AND PLANNING DIVISION


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# 1. Executive Summary

As the utility workforce ages and workers are leaving at a faster pace than people entering the workforce one important question remains unanswered: Are the four investor-owned utilities (IOU's): Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric Company (SDG&E), and Southern California Gas (SoCalGas) regulated by the California Public Utilities Commission (CPUC), prepared and equipped to handle the potential labor shortage? Further, as a result of, retirement, attrition, skill gaps in applicants and development of new technology over time such as grid-modernization, will the utilities be able to fill this increasingly urgent need in the electric and gas energy industry? If these issues are not managed efficiently the costs associated with that inefficiency may be borne by ratepayers? The CPUC can play a significant role by providing the utilities with longer term guidance that will help the IOUs build programs that are efficient and which reflect the workforce objectives the CPUC may want to foster.

An additional factor to consider is that the utility sector will be competing for the same workers as other employment sectors. To the extent that the utilities are positioned to compete for the best workers they will be able to hire a workforce that may be more capable of delivering safe, reliable and reasonably priced energy. A well designed program to attract and train future utility workers will help attract that sort of workforce.

# 2. Exiting Utility Workforce affected by retirement and attrition

Due to pending California Workforce Utility data, a representative 2011 survey from Center for Workforce Development (CEWD) will be used to frame the current utility workforce demographic. According to the survey, the economic downturn of 2008-2009, and the related wealth destruction in the markets, made some workers postpone retirement. However, those retirements will come and the need for new entrants into the utility industry workforce remains. Another factor affecting employees leaving for reasons other than retirement is attrition. Annual attrition rates dipped from 5 percent to 2.2 percent over previous years. Although, projections show that hiring is increasing, it is still not forecasted to reach the 2008 levels by 2015.[1]

Nationally, the workforce demographic of the Electric and Natural Gas utilities has dipped from 535,000 in 2009 to 525,000 in 2011. "Of those employees, 42 percent, or 225,000, fall into CEWD's key job categories- Line workers, Technicians, Plant Operators, and Engineers."[1] According to Table 1.1, a significant percentage of the current workers will need to be replaced by new workers in the next 3-8 years. These replacements have a 1:1 ratio, which means that each retiring worker will be replaced with one new worker. However, these replacements are only for existing positions, and does not account for new positions that will be created from new technologies such as grid-modernization. Those job estimates will only be available after empirical data is gathered post Smart Grid Deployment. KEMA analysts estimate that close to 140,000 permanent new jobs will be created post Smart Grid Deployment.[8]

**Table 1.1: Source- CEWD 2011 Survey findings for Energy Workforce in U.S**

| | Potential Replacements 2010 to 2015 | | Potential Replacements 2015-2020 | |
|---|---|---|---|---|
| Job Category | Potential Attrition & Retirement | Estimated Number of Replacements | Potential Retirement | Estimated Number of Replacements |
| Line Workers | 32% | 22,100 | 15% | 10,300 |
| Technicians | 39% | 28,500 | 19% | 13,500 |
| Plant Operators | 37% | 12,400 | 17% | 5,800 |
| Engineers | 38% | 10,600 | 15% | 4,100 |
| Total* | 36% | 73,600 | 16% | 33,700 |

**Totals Exclude Nuclear*

Over the next decade, almost 62 percent of the electric energy industry has the potential to retire or leave for other reasons. More recent survey results suggest that utilities will need to replace 46 percent of skilled technician positions by 2015 because of retirement or attrition. Approximately, 50 percent of the utility engineering workforce and 40 percent of all utility transmission and distribution workers will be eligible to retire by 2015.1

As of 2010, the average age of the energy industry workforce employed by utilities is aged 46 years or older. CEWD's comparison of national utility age distribution from 2006 to 2010 shows that the number of employees age 53 and above has gone up, while workers between ages 18-27 have decreased.[1] Changes in the age distribution, reflects workers who have made mid-career changes or are waiting to retire. At the same time, there is a lack of a younger workforce pipeline to replace them.

## 3. Grid Modernization impacts utility workforce changes

Another factor impacting the utility workforce changes will be Grid Modernization in the next decade. The Modern Grid industry is based on Smart Grid technologies; the two terms are used interchangeably to refer to grid-modernization. With this new technological innovation utilities will be faced with new positions, job openings, skills, competencies, and training programs that respond to the emerging smart grid applications. While the entire utility workforce is aging the workers in the smart grid domain may be the most pressing problem area. Not only are the older workers leaving, their replacements need additional skills on top of those whose shoes they will be filling. Focusing on developing programs in this area will provide the opportunity to build and the scale up training programs on a state-wide basis. Lessons learned from those efforts can then be transferred to other workforce areas.

In the past utility workforce had to only support communication between a few key energy-delivery assets and potentially a land mobile radio network for field workers. However, as the technology evolves, the modern grid will allow a two-way flow of electricity and information that is capable of monitoring everything from power plants to customer preferences and individual appliances/equipment.[1] "A smarter grid will enable many benefits, including improved response to power demand, more intelligent management of outages, better integration of

renewable forms of energy, and the storage of electricity."2 For example, the prevalence of communications systems in smart grid deployment will lead to increased needs for IT personnel familiar with existing utility grid infrastructure.

Table 1.2 shows what the Modern Grid (Smart Grid) sector looks like and the breakdown of technological opportunities in the sector such as: Transmission & Distribution, Power Management & Energy Efficiency Products, Energy Storage and Distributed Energy.[3]

**Table 1.2: Source – Collaborative Economics**

| Modern-Grid Sector | |
|---|---|
| **TRANSMISSION & DISTRIBUTION** | Energy Infrastructure<br>Cable & Equipment<br>Power Monitoring<br>Power Quality & Testing<br>Sensors & Controls |
| **POWER MANAGEMENT & ENERGY EFFICIENCY PRODUCTS** | Meters & Measuring Devices<br>Energy Management Software, Services & Devices<br>Energy Conservation Products & Software<br>Smart Lighting Systems<br>Solar Appliances & Devices<br>Home Area Networks & Home Automation |
| **ENERGY STORAGE** | Advanced Batteries<br>Fuel Cells<br>Hybrid Systems<br>Uninterruptible Power Supply<br>Battery Components & Accessories |
| **DISTRIBUTED ENERGY** | Clean Energy Generation<br>Accessory Equipment & Controls<br>Research & Testing<br>Energy Research |

# 4. Skills and Competency Gaps

The Generation, Transmission and Distribution sector existing skills and competencies will be needed for the design, implementation, and maintenance of the Smart Grid network.[4] Core skills such as engineering skills, data management skills, and business management expertise, among other skills will all be highly valued in smart-grid related jobs. Training will be required as new technologies are introduced, but the existing competencies will not change. Smart meter pilots, extra-high-voltage sensors, new and emerging smart grid applications require new skills to overlay on existing core competencies.5

For example, utilities have recently deployed the advanced metering infrastructure (AMI) pilots. To find the labor pool to meet this demand, utilities will have to create a skill-gap requirement and career path for existing

meter readers to transition into a meter technician or line worker position. Emerging technologies resulting from smart grid lead to new positions being created resulting in traditional jobs such as meter readers to become obsolete.[4] New meter technicians positions will require basic skills of a meter reader in combination with additional higher level skills. These skill and competency gaps can be addressed with further training, and required industry recognized pre-employment testing. CEWD has developed a detailed Competency Model for the Generation, Transmission and Distribution sector to help bridge the gap of required skills and competencies for the modern grid workforce development.[6]

**Table 1.3: Source-GridWise Alliance**

| Electric Industry Workforce Classifications Affected by Smart Grid Deployment | |
|---|---|
| Line Technicians | Management/ Supervision |
| Meter Readers | Customer Service Reps |
| Meter Electricians | Supply Chain |
| Engineers (New Construction) | Meter Lab Repair |
| System Operation/Dispatch | New Hires |
| Administrative Support | Communications Technicians |
| Substation Operations | Contract Construction/ Engineering Labor |
| Engineering Support (planning /reliability) | Other Support (IT, Staffing) |

Table 1.3 represents many of the job classifications impacted by the deployment of the smart grid system. New jobs within the sector that require a higher skill set also come with higher wages leading to an economic benefit to the retrained employee and the economy. Smart Grid related jobs will pay 50 to 67 percent more annually than existing positions.[5] Upgrading the current grid will cause utilities to adjust the number of positions within these classifications to suit their smart grid deployment plans.

## 5. Skills Requirements:

Since the modernized grid is still evolving the current skill requirements are basic utility industry skills that will be subject to future modification in the next couple of years. Implementation of the modernized grid will result in updating current knowledge, skills and abilities (KSA's) leading to new roles and responsibilities in the utility workforce. Upgraded skills will be needed in the advent of the new technologies and operation of smart grid elements, as well as to the business and management issues by the smart grid implementation. Utility workers with engineering, data management and business management expertise, among other skills, will be crucial to the modern grid industry.[5]

The Illinois Institute of Technology conducted the research on the "U.S Smart Grid of the Future," and came up with smart grid skills that fall into 4 primary categories; 1) Smart Grid Technology, 2) Smart Grid Systems Integration & Communications, 3) Smart Grid Organizational Management and 4) Smart Grid Customer

Management. These categories represent the knowledge and training gaps based on current smart grid visions and are exhaustive. However, they do offer a framework for understanding the necessary knowledge and skill requirements that can be tailored by the utilities as the smart grid network develops.7

The smart grid skills are shown below. For detailed breakdown of the specific skills refer to "The Smart Grid Workforce of the Future," developed by Illinois Institute of Technology.[7]


**Figure-A:**

## 6. Training Needs:

According to CEWD and the GridWise Alliance, incumbent utility workers will need upgraded smart-grid related job training to respond to the new technologies, procedures and protocols it will create. Common technology knowledge will be needed for successful collaborations between Engineers, line workers and managers. "Almost 100 percent of the current utility power engineers will have some form of Smart Grid training. By 2014, California will experience a net-shortage of 40,000 engineers, which will limit the pool of power engineers that can be recruited for the modern grid."8

Managing the transition to the Modern Grid and California's economic potential is dependent on the utility workforce that will be staffing this new transition. A workforce supply shortage of power engineers and utility workers employed by the modern grid industry will cause a delay in the anticipated smart grid deployment in 2015. According to Electric Power Research Institute (EPRI), a workforce readiness delay causing smart grid penetration levels to lag by 1 percentage point would cost California hundreds of millions of dollars in efficiency and reliability losses as well as the unnecessary additions of infrastructure. This workforce delay is projected to cost the state between $4.3 million and $13.5 million in unrealized energy savings for 2015 alone.9

A 2009 survey, of PG&E, SCE, and SDG&E table below identifies the following Smart Grid engineering training requirements for incumbents by Job Classification through 2014. This is a snapshot of the 3 utilities regulated by CPUC. However, SoCalGas was unavailable to give the total utility picture. Although the data was derived in 2009 the estimates are still accurate for the current 2012-2014 year. [10]

**Table 1.4 Source: PG&E, SCE and SDG&E combined 2009 data.**

**Target Population for Smart Grid Training through 2014**

| Incumbent Engineers | SCE | PG&E | SDG&E | Total |
|---|---|---|---|---|
| *Power Engineers* | 275 | 190 | 102 | 567 |
| *Telecommunications* | 15 | 15 | 10 | 40 |
| *Information Technology* | 40 | 17 | 60 | 117 |
| *Other Engineers* | 25 | 20 | 10 | 55 |
| **Incumbent Subtotals** | **355** | **242** | **182** | **779** |
| *Retirements* | 115 | 102 | 43 | 260 |
| *Normal Attrition Replacement* | 19 | 17 | 7 | 43 |
| *Systemic Growth* | 180 | 170 | 135 | 485 |
| **Total Training Requirement** | **669** | **531** | **367** | **1,567** |

A training gap exists for the future smart grid engineering workforce, that lack required courses in business, lack of teamwork exercises, structure to accommodate internships and practical hands-on experience.[8] Even though the California Smart-Grid Center has targeted Power Engineers as the current primary Smart-Grid occupation to develop education and training needs for. "PG&E is looking at existing Electrical Engineers to create a curriculum that will transition them into Power Engineers," Yonnie Leung, PG&E Workforce Development Director.

The utility industry still lacks the necessary education and training for modern grid industry workers included in tables 1.1 and 1.3. Creating education and training programs or courses also for non-engineering occupations such as Meter Readers and Line Technicians will become critical as the Smart Grid evolves and Meter Readers become obsolete.

In addition, creating a pipe-line of new workers will be integral to filling exiting utility worker gaps. Combining candidates with engineering and IT skills that incorporate geographic information system (GIS), supervisory controls and data acquisition (SCADA) system, distribution engineering and design, conservation, energy efficiency and AMI with non engineering skills such as oral and communication, project management,

presentation, financial analytical skills will be needed.[4] A well rounded candidate in these areas will be equipped with the related training and education to be a future utility modern grid worker.[4]

# 7. Opportunities for Modern Grid Workforce Development

## Statewide Partnerships Framework

In April 2010, the California Smart Grid Workforce Development Network (Network) staffed by Sacramento State University Smart Grid Center was funded by a $750,000 grant from Department of Energy's Funding Opportunity Announcement (FOA). This Network model addressed a Statewide Partnership Framework that creates a synergistic network between public/private industry to address smart-grid utility workforce education and training needs. The Governance structure in Figure B shows the stakeholders represented in the Advisory Council to the Smart Grid Workforce Development Network to address the emerging smart-grid workforce issues faced by the industry. Partners such as: the California Energy Commission, California Independent System Operator (CAISO), California Workforce Investment Board, Education, Labor, and Industry can leverage its contributions and develop a pool of new and incumbent Smart Grid workers to achieve the economic impacts the state needs.[8] The objective is for forward-thinking utilities, technology vendors, power engineering companies, universities, and government agencies to leverage lessons learned and best practices by participating in the California Smart Grid Workforce Development Network.

Primary characteristic of these partnerships or new ecosystem are:[8]

- Partnerships that engage the utilities, educators, labor, industry associations, contractors, and government agencies such as the Workforce Investment Board in collaborative modes
- Communications and analysis that provides continuous definition of "the right workers for the right jobs at the right time"
- Streamlined processes for responsive introduction of education and training programs
- A statewide system of credentialing and articulation that assures portability among
- California's CSU and community college institutions
- A combination of in- class and online instruction supporting the schedules of incumbent workers
- A structure of "stackable credentials" that create continuity in career pathways across the CSU and California community college systems
- Managed professional development opportunities for instructors to maintain relevance to
- the needs of the utilities
- An integrated set of work experience programs, including project- based learning,
- internships, fellowships, and apprenticeships
- Creation of linkages with and articulation from high school and ROP programs
- Adequate funding to sustain ongoing development and evolution of programs
- Ownership of the ecosystem by an organization funded and staffed for successful execution

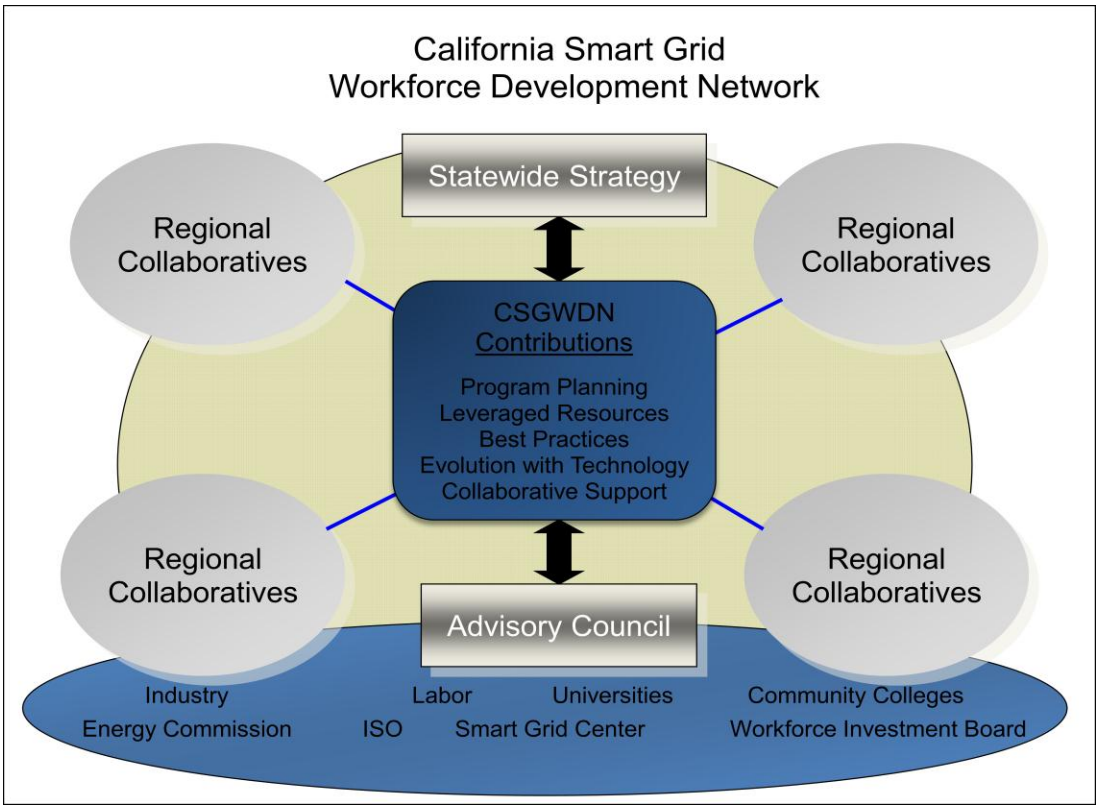


**Figure B:**

Since the inception of the California Smart Grid Workforce Development Network, the utility workforce industry still lacks a Statewide California Smart Grid Needs Assessment to identify stackable credentials also comprised of micro-credentials for incumbent workers, and the knowledge skills and abilities (KSA's), training and educational courses for the future Modern Grid employee.

Moreover, California's university and community colleges do not offer well mapped certificate and degree programs to develop the career pathways needed for the utility industry. Only, PG&E's Power Pathway program has a portfolio of certificate programs that link to utility workforce needs, while the other two IOU's lack such programs for the development of their utility workforce.

The four investor-owned utilities can leverage the partnerships developed by the California Smart Grid Workforce Development Network, and use it to further develop its Smart-Grid related new skills, training and education gaps for the future of its grid modernized utility workforce.

## 8. Rate Payer impacts addressed in General Rate Case (GRC)

In June 2010, the CPUC adopted Decision 10-06-047 requiring PG&E, SDG&E and SCE to submit their Smart Grid Deployment plans by 2011. In this decision, the three IOU's are to justify "cost and benefit procedures that the Smart Grid Deployment Plans should use to enumerate, quantify, and -- to the extent feasible -- monetize the costs and benefits of Smart Grid investments. The decision requires the plans to follow cost-effectiveness

analysis, to meet legislatively mandated goals in a cost effective way, and requires the presentation of the "business case" analysis for other components of the Smart Grid." [11]

While, the costs to serve customers who have more sophisticated equipment and maintaining a more complex distribution system may rise, grid modernization is expected to decrease costs in areas such as energy and capacity costs. To maximize the benefits and minimize the costs, utilities should be prepared to deal with the challenges of a modern grid, such as workforce readiness.

Utility workforce related costs are handled in Phase 1 of each General Rate Case (GRC).Claims for costs associated with lack of personnel can be vetted and translated into authorized increases in revenue requirements. IOU's regularly request needed workforce and training budgets in each GRC Phase 1, and are encouraged to continue any needed planning to provide the training and salaries necessary to meet their obligations to provide safe, reliable, low-cost service.

Rate-shock can be mitigated by requiring the IOU's to deploy smart grid technologies in an incremental manner to maximize the benefit to the ratepayers and to achieve the benefits of smart grid technology. In addition, require the utilities to provide a cost-benefit analysis for workforce development incrementally as each technology is deployed in the GRC Phase 1. Secondly, costs associated with incumbent worker training and creating a new pipeline of workers for the Generation, Transmission and Distribution sector should also be vetted in each IOU's GRC Phase 1. Workforce development costs should be evaluated incrementally as new technologies are deployed and the workforce shortage is recognized.

# 9. Recommendations

The current Smart Grid deployment plan does not take into account the exiting utility workforce, and the impact it will have on the IOU's to implement Smart Grid deployment. To this end, there is a need for opening an Order Instituting Rulemaking (OIR) addressing the need for up-skilling incumbent workers and developing a new pipeline of workers to successfully implement grid-modernization. This OIR should, at a minimum, provide guidance to the IOUs for:

- Using the Energy Efficiency workforce education sector strategy training development model to;
  - 1) Develop a California Statewide Generation, Transmission and Distribution Workforce Needs Assessment to determine number of utility workers, skills and training needed for successful deployment of Smart Grid technologies.
  - 2) Partner with California Smart Grid Workforce Development Network to leverage existing collaborations with the CSU and community college institutions.
- Create a competency model (skills-gap analysis) combined with educational courses and stackable credentials, that create continuity in career pathways for incumbent and new pipeline of utility workers.
- Submit an incremental utility workforce cost-benefit analysis in the Smart Grid Deployment Plans-Phase 1 of the GRC, for ongoing shortage of workers or training as smart grid technologies are deployed over-time.

# End Notes

[1] "Gaps in the Energy Workforce Pipeline: 2011 CEWD Survey Results." *Center for Energy Workforce Development*. http://www.cewd.org (accessed May 2012).

[2] "Smart Grid Basics," *Federal Smart Grid Task Force*. July 14 2010.

[3] "Smart Grid Deployment and the Impact on Silicon Valley." *Prepared by Collaborative Economics*, Silicon Valley Smart Grid Taskforce,2011.

[4] "The Smart Grid Evolution: Impact on Skilled Utility Technician Positions," *Center for Energy Workforce Development* . http://www.cewd.org (accessed May 2012)

[5] "The U.S. Smart Grid Revolution: Smart Grid Workforce Trends 2011." *Prepared by KEMA*, Gridwise Alliance, July 2011.

[6] "Energy Industry Competency Model: Generation, Transmission and Distribution, "Center *for Energy Workforce Development*. http://www.cewd.org (accessed May 2012).

[7] "The Smart Grid Workforce of the Future: Job Impact, Skill Needs, and Training Opportunities." *Developed by the Illinois Institute of Technology and West Monroe Partners*,2011.

[8] "California Smart Grid Workforce Development Network," Sacramento State California Smart Grid Center. September 2010.

[9] "Observations of Investments in Smart Grid, Electric Power Research Institute," March 2009.

[10] Combined workforce analysis by PG&E,SCE, and SDG&E, November 2009.

[11] Decision10-06-047, adopting requirements for Smart Grid Deployment Plan, pursuant to Senate Bill 17 (Padilla), chapter 327, statutes of 2009.